

Cardiac pacing in Northern Ireland 1979–1988

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SUMMARY

The implantation rate of cardiac pacemakers in Northern Ireland rose from 55·8 per million population in 1979 to over 180 per million in 1988, with the emergence of a second pacemaker implantation centre. However, the implantation rate in Northern Ireland remains less than that of many other countries. Over the period complete heart block fell as an indication from 45% to 34% and sinus node disease rose from 16% to 28%. Symptoms necessitating pacing remained unchanged, syncope being the most common. Ventricular demand pacemakers constituted a lower proportion of implants than anywhere else in the world and more atrial demand and dual chamber pacemakers were implanted than in most other countries. Insufficient patients are being referred for pacing in Northern Ireland but a high proportion of those who are referred receive modern sophisticated pacemakers.

INTRODUCTION

The first fully implantable cardiac pacemaker was inserted in 1959¹ and the first implant in Northern Ireland was in 1969 by Dr J Geddes. Since then there have been rapid advances in pacemaker technology, including the development of stable atrial and ventricular leads that can be inserted intravenously, and the development of smaller and longer lasting pacemakers with sophisticated functions which can be implanted under local anaesthetic with minimal morbidity. Permanent pacemaker implantation has become a relatively straightforward technique and the indications for pacing are no longer restricted to life-threatening bradycardias. This has resulted in a rapid increase in the numbers of pacemakers implanted worldwide.

This paper documents the change in pacing practice in Northern Ireland over the ten year period 1979–1988 and compares with other parts of the United Kingdom and the rest of the world.

METHODS

Permanent pacemakers are implanted at two centres in Northern Ireland: the Belfast City Hospital and the Royal Victoria Hospital. These hospitals register the details of permanent pacemaker implantations with the British Pacing Group database. Data for the two hospitals were obtained from the British Pacing Group with permission from the cardiologists in each hospital. This was compared with hospital records to exclude duplications, omissions or other inaccuracies.

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Sex, age at pacemaker implantation, electrocardiographic indications for implantation, symptoms requiring pacing, and pacing modes employed were recorded. These results were compared with published world data for 1986.²

RESULTS

Only first time implantations are considered. The total number of pacemakers implanted over the ten year period in both centres was 1935, with the greater proportion in the Royal Victoria Hospital (63%). The numbers implanted annually increased from 87 in 1979 to 290 in 1988 (Table I). The proportion implanted in the Belfast City Hospital rose from 17% to 53% over this period. The initial implantation rate per million population was 55.8 in 1979 rising to 152 in 1986 and 185.9 in 1988 (Northern Ireland population 1.56 million — 1981 census). The overall United Kingdom figures are 111 per million in 1979 and 148 in 1986. The average age at implantation has gradually increased from approximately 67 in 1980 to nearly 72 in 1988, with a slight excess of males in most years.

TABLE I

Numbers of first time pacemaker implantations in two hospitals in Northern Ireland, and implantation rate per million population

Year	Pacemaker numbers			Implantation rate (per million)
	RVH	BCH	Total	
1979	72	15	87	55.8
1980	98	26	124	79.5
1981	105	31	136	86.6
1982	143	35	178	114.1
1983	124	56	180	115.4
1984	131	81	212	135.9
1985	150	85	235	150.6
1986	141	96	237	151.9
1987	122	134	256	164.1
1988	137	153	290	185.9
Total	1223	712	1935	124.0

Indications for pacing

The main indications for pacing were heart block (including complete heart block, second and first degree heart block, bundle branch block and atrial fibrillation with bradycardia) and sinus node disease. The number of pacemakers implanted for complete heart block gradually increased over the first five year period but remained approximately 95 per year thereafter. The relative frequency of this diagnosis fell from 44.8% to 33.8% of the total over the period. There was a rise in numbers of pacemakers implanted for sinus node disease from 14 in 1979 (16.1%) to 78 in 1988 (27.8%). No patients were paced for carotid sinus hypersensitivity in 1979 whereas in 1988 this indication accounted for 5.3% of the total. There was no change in the frequency of implantation for other forms of heart block, with second degree heart block accounting for approximately 9%, bundle branch block 4%, and atrial fibrillation with bradycardia 6% throughout the period.

Symptoms

Symptoms at the time of pacing have remained fairly constant. Syncope has been the most frequent indication, around 50% for the whole period. Dizzy spells have risen from 12% to 20%. These two symptoms represent definite indications for pacing about which there is little controversy (if they are caused by bradycardia). Less definite symptoms such as bradycardia alone have decreased over the ten year period from 18% to 6%. These three symptoms have consistently accounted for more than 75% of those implanted, but their proportion has decreased as other indications, such as pacing for tachycardia have increased.

Pacing modes

This is the area where there has been the greatest change over the ten year period. In 1979 single chamber ventricular demand pacing was the predominant mode of pacing and accounted for 87% of the total, the other two modes used being atrioventricular sequential (DVI) and atrial demand (AAI).

Over the period the frequency of these three modes of pacing reduced and this was associated with the development and use of other more sophisticated modes of pacing — two more dual chamber modes (DDD and DDI), rate responsive pacing (VVIR) and antitachycardia pacing (Table II).

TABLE II
Different pacing modes used in 1979 and 1988

Mode		Pacemakers implanted (%)	
		1979	1988
Single chamber:			
Ventricular demand	(VVI)	76 (87)	120 (40)
Atrial demand	(AAI)	5 (5)	22 (8)
Dual chamber:			
Atrioventricular sequential	(DVI)	6 (7)	25 (9)
	(DDD)	0 (0)	89 (31)
	(DDI)	0 (0)	11 (4)
Rate responsive	(VVIR)	0 (0)	20 (7)
Others		0 (0)	3 (1)

UK and world data

In 1986 the implantation rate per million population was lower in Northern Ireland and in the UK as a whole, compared with most other Western countries (Figure). Ventricular demand mode accounted for a much lower proportion of the total in Northern Ireland, meaning that the more sophisticated atrial demand and dual chamber pacemakers were used more frequently than in most other countries. Symptoms resulting in pacemaker implantation differed. In Northern Ireland and in the UK as a whole relatively small numbers were implanted for symptoms such as bradycardia, whereas this indication was more common in those countries with higher implantation rates.

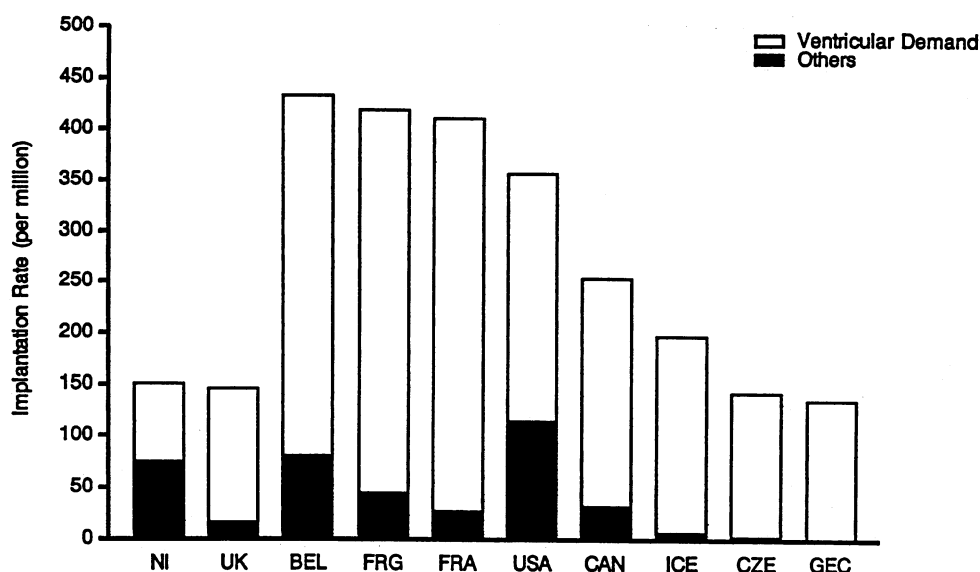


Figure. Implantation rates, and proportion ventricular demand mode, for Northern Ireland and the UK compared with other countries for 1986. (Bel = Belgium, FRG = West Germany, Fra = France, Can = Canada, Ice = Iceland, Cze = Czechoslovakia, Gec = Greece).

DISCUSSION

During the ten year period many advances have occurred in pacemaker technology, and permanent pacemaker implantation is now a straightforward procedure performed under local anaesthesia, with a minimal morbidity and mortality. There is now no doubt that mortality in patients with complete heart block, whether symptomatic or not, is significantly improved with pacing and all patients with this condition should be paced.³ Second degree heart block is also a frequent indication. Mobitz type II block occurs when the block is below the level of the atrioventricular node and usually progresses to higher degree atrio-ventricular block with Stokes Adams attacks and the risk of sudden death.⁴ Chronic type I second degree block (as opposed to the transient type that occurs following an inferior myocardial infarction) was generally believed to have a relatively benign course, and pacing was considered only for extreme bradycardia or if the patient was symptomatic.⁵ Recent work would suggest that the prognosis in this condition is not so good and pacing should be considered.⁶

Patients with bifascicular block are at higher risk of development of high grade atrioventricular block,⁷ but the best means of predicting those most at risk is not clear. At present patients with bifascicular block and a prolonged PR interval with a history of syncope for which no other cause can be found probably require pacing.⁸ It is generally agreed that mortality in sinus node disease has not been shown to be improved by pacing, and that patients with this condition should only be paced for relief of such symptoms as syncope and heart failure.⁹ Carotid sinus hypersensitivity resulting in syncope is now another frequent indication for pacing, accounting for 5.3% of all cases in Northern Ireland in 1988. Pacing improves symptoms in a significant proportion of these patients.¹⁰ Tachycardia control and termination represents a small but significant proportion of pace-makers implanted.

The implantation rate in Northern Ireland and throughout the UK is much lower than in many countries throughout the world. The most recent figures available are for 1986, when most western European and North American countries were implanting more than 200 per million, and some countries more than 400 per million population.² The reasons for these differences in implantation rates are not clear. Possible explanations are a lower prevalence of conditions requiring pacemaker implantation in the UK, underdiagnosis or undertreatment of conditions requiring pacing, or overimplantation in other countries.

The high rate of bradycardia as a symptom and sinus node disease as an indication for pacing in some countries with high implantation rates may reflect inappropriate pacing of asymptomatic patients with sinus node disease. It was suggested in 1984 that too many pacemakers were being implanted in the USA.¹¹ This resulted in the introduction of stricter criteria for pacemaker implantation and was followed by a reduction in the implantation rate in that country from 518 per million in 1981 to 359 per million in 1986. This figure is still over twice that of the UK for that year.

A reason for the lower implantation rate in the UK may be a different prevalence of conditions requiring pacing. Shaw and Kekwick¹² carried out an eight year survey in the Devon area in which they asked general practitioners to report patients who they thought had abnormal bradycardias. They included complete heart block and sinus node disease as indications for pacemaker implantation and found an incidence of complete heart block of 97 per million and symptomatic sinus node disease of 77 per million, a total rate of 174 patients per million requiring pacemaker implantation per year for these conditions. In Northern Ireland in 1988 the implantation rate was 20 per million for second degree heart block, 15 per million for atrial fibrillation and bradycardia, 10 per million for carotid sinus hypersensitivity, 3 per million for bundle branch block and 20 per million for other indications. Taken with the 174 per million estimated by Shaw and Kekwick for complete heart block and sinus node disease, this would suggest that a total implantation rate of 250 – 300 per million would be more appropriate.

Thus the discrepancy between the implantation rates in the UK and other countries may be due to a degree of overtreatment in those countries, but it also seems that there is undertreatment of patients with conditions requiring a permanent pacemaker in the UK. Examination of data from Northern Ireland may suggest reasons why this should be so. Prior to 1983 pacing in Northern Ireland was performed predominantly in one centre, the Royal Victoria Hospital, where 143 implants were performed in 1982. In that year only 35 implants were performed in the Belfast City Hospital. However, over the next five years the number of implantations in the latter hospital increased to 153 in 1988, but there has not been any reduction in the numbers implanted in the RVH. This would suggest that the implantation rates reflect the number of centres performing implantation, greater availability of a pacing service resulting in a greater referral for pacing. It may be that the UK practice of implanting pacemakers in regional centres specialising in pacing gives rise to lower referral rates for investigation and treatment of bradycardias and syncope than if pacing were to be performed in district general hospitals. It has been suggested that the higher implantation rate in the USA may be due to the widespread availability of a pacing centre in almost every community hospital.¹³

Fewer ventricular demand pacemakers are implanted in Northern Ireland than in the UK or any other country, but more atrial demand and dual chamber

pacemakers are used. The high implantation rate for these latter types of pacemakers probably reflects the fact that in Northern Ireland pacing is carried out in two specialised cardiology units with particular interests in pacing.

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REFERENCES

1. Elmqvist R, Senning A. An implantable pacemaker for the heart. Proceedings of the Second International Conference on Medical Electronics, Paris 1959. London: Iliffe: 253-4.
2. Feruglio GA, Rickards AF, Steinbach K, Feldman S, Parsonnet V. Cardiac pacing in the world: a survey of the state of the art in 1986. *PACE* 1987; **10**: 768-77.
3. Siddons HS. Deaths in long-term paced patients. *Br Heart J* 1974; **36**: 1201-9.
4. Langendorf R, Pick A. Atrioventricular block, type II (Mobitz): its nature and clinical significance. *Circulation* 1968; **38**: 819-21.
5. Strasberg B, Amat-Y-Leon F, Dhingra RC, et al. Natural history of chronic second-degree atrioventricular nodal block. *Circulation* 1981; **63**: 1043-9.
6. Shaw DB, Kekwick CA, Veale D, Gowers J, Whistance T. Survival in second degree atrio-ventricular block. *Br Heart J* 1985; **53**: 587-93.
7. Scheinmann MM, Peters RW, Sauvé MJ, et al. Value of the H-Q interval in patients with bundle branch block and the role of prophylactic permanent pacing. *Am J Cardiol* 1982; **50**: 1316-22.
8. Lichstein E, Gupta PK, Chadda KD. Indications for pacing in patients with chronic bifascicular block. *PACE* 1978; **1**: 540-3.
9. Shaw DB, Holman RR, Gowers JI. Survival in sinoatrial disorder (sick-sinus syndrome). *Br Med J* 1980; **280**: 139-41.
10. Madigan NP, Flaker GC, Curtis JJ, Reid J, Mueller KJ, Murphy TJ. Carotid sinus hypersensitivity: beneficial effects of dual-chamber pacing. *Am J Cardiol* 1984; **53**: 1034-40.
11. Chokshi AB, Friedman HS, Malach M, Vasavada BC, Bleicher SJ. Impact of peer review in reduction of permanent pacemaker implantations. *JAMA* 1981; **246**: 754-7.
12. Shaw DB, Kekwick CA. Potential candidates for pacemakers. Survey of heart block and sinoatrial disorder (sick sinus syndrome). *Br Heart J* 1978; **40**: 99-105.
13. Selzer A. Too many pacemakers. *N Engl J Med* 1982; **307**: 183-4.